



Europäisches Patentamt
European Patent Office
Office européen des brevets

0 278 658
A3

EUROPEAN PATENT APPLICATION

Int. Cl.⁵: C12N 15/00, A01H 1/00

② Date of filing: 02.02.88

**Canberra Australian Capital Territory
2601(AU)**

⑦ Inventor: Peacock, W. James
16 Brassy Street Deakin
A.C.T. 2600(AU)

Inventor: Walker, John C.
17 Hemmant Street O'Connor
A.C.T. 2601(AU)

Inventor: Dennis, Elizabeth
100 Hopetown Court Yarrahwanda
A.C.T.(AU)

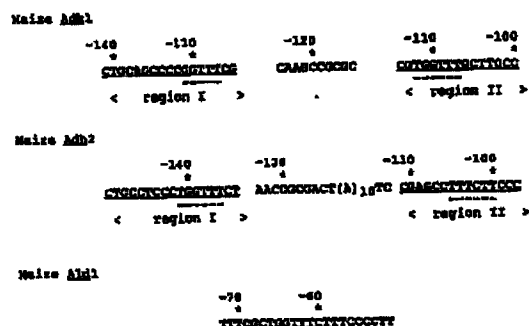
Inventor: Howard, Elizabeth
5 Acacia Avenue Berkeley
California 94708(US)

74 Representative: Fisher, Adrian John et al
CARPMAELS & RANSFORD 43 Bloomsbury
Square
London WC1A 2RA(GB)

54 Plant anaerobic regulatory element

(57) DNA sequence elements which affect anaerobic induction of genes in plants are identified and characterized. These sequence elements, designated anaerobic regulatory elements, confer inducibility by anaerobic condition on downstream plant-expressible promoters and their associated structural genes. In particular, those sequences associated with anaerobic induction of the maize alcohol dehydrogenase and aldolase genes have been identified. These sequence elements can be employed in combination with appropriately positioned plant-expressible genes to product chimeric, anaerobically inducible genes. Such constructs are useful for the selective expression of structural genes under anaerobic conditions in plants.

FIG. 1 Comparison of conserved anaerobic regulatory element sequences from several different plant anaerobically induced genes





European Patent
Office

EUROPEAN SEARCH REPORT

Application Number

EP 88 30 0852

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. 4)
X	THE EMBO JOURNAL, vol. 6, no. 1, January 1987, pages 11-16, IRL Press Ltd, Eynsham, Oxford, GB; J.G. ELLIS et al.: "Maize Adh-1 promoter sequences control anaerobic regulation: addition of upstream promoter elements from constitutive genes in necessary for expression in tobacco" * Page 15, left-hand column, lines 10-17 *	1,2,5- 12,16- 23,25- 29,32- 34	C 12 N 15/00 A 01 H 1/00
Y	IDEM ---	13-15, 24	
O,X	J. CELLULAR BIOCHEMISTRY SUPPL. 10D SYMPOSIUM ON TRANSCRIPTIONAL CONTROL MECHANISMS HELD AT 15TH ANNUAL MEETING OF THE UCLA SYMPOSIA ON MOLECULAR AND CELLULAR BIOLOGY, 6th-13th April 1986, page 136, abstract no. 0163; J.C. INGERSOLL et al.: "Identification of the DNA sequence elements responsible for anaerobic induction of maize Adh1" * Abstract *	1,25	
O,P X	UCLA SYMP. MOL. CELL. BIOL., NEW SER., V62 PLANT GENE SYSTEMS AND THEIR BIOLOGY, PROCEEDINGS OF A CIBA-GEIGY-UCLA SYMPOSIUM, Tamarron, Colorado, 2nd-8th February 1987, pages 263-277, Alan R. Liss, Inc.; J. PEACOCK et al.: "Developmental and environmental regulation of the maize alcohol dehydrogenase 1 (Adh1) gene: promoter-enhancer interactions" * Whole document especially page 275, paragraph 1 * --- -/-	1,2,5- 12,16- 34	TECHNICAL FIELDS SEARCHED (Int. Cl. 4) C 12 N A 01 H
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 20-04-1990	Examiner MADDOX A.D.
<p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</p> <p>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons * : member of the same patent family, corresponding document</p>			

EPO FORM 183 (6.82) (7/83)



DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
O,P Y	IDEM ----	3,4,13-15	
P,X	PROC. NATL. ACAD. SCI. USA, vol. 84, October 1987, pages 6624-6628; J.C. WALKER et al.: "DNA sequences required for anaerobic expression of the maize alcohol dehydrogenase 1 gene" * Whole document *	1,2,5-12,16-34	
O,P X	NATO ASI SERIES. SERIES A, LIFE SCIENCES, vol. 140, PROCEEDINGS OF A NATO ADVANCED STUDY INSTITUTE ON PLANT MOLECULAR BIOLOGY, Copenhagen, 10th-19th June 1987, edited by D. von Wettstein and Nam-Hai Chua, pages 407-417, Plenum Press, New York, US; E.S. DONNIS et al.: "The response to anaerobic stress: Transcriptional regulation of genes for anaerobically induced proteins" * Pages 410-415 *	1-34	
P,X	PLANTA, vol. 170, 1987, pages 535-540, Springer-Verlag; E.A. HOWARD et al.: "Regulated expression of an alcohol dehydrogenase 1 chimeric gene introduced into maize protoplasts" * Whole document *	1,2,5-12,16-23,25-31	
D,Y	NUCLEIC ACIDS RESEARCH, vol. 13, no. 3, 1985, pages 727-743; E.S. DENNIS et al.: "Molecular analysis of the alcohol dehydrogenase 2 (Adh2) gene of maize" * Whole document *	13-15	
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 20-04-1990	Examiner MADDOX A.D.
CATEGORY OF CITED DOCUMENTS X: particularly relevant if taken alone Y: particularly relevant if combined with another document of the same category A: technological background O: non-written disclosure P: intermediate document		T: theory or principle underlying the invention E: earlier patent document, but published on, or after the filing date D: document cited in the application L: document cited for other reasons &: member of the same patent family, corresponding document	



DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. 4)
D,Y	SCIENCE, vol. 232, 30th May 1986, pages 1106-1112; R. FLUHR et al.: "Organ-specific and light-induced expression of plant genes" * Page 1108, figure 2 *	24	
A	CHEMICAL ABSTRACTS, vol. 106, 1987, page 157, abstract no. 11492z, Columbus, Ohio, US; P.M. KELLEY et al.: "The complete amino acid sequence for the anaerobically induced aldolase from maize derived from cDNA clones", & PLANT PHYSIOL. 1986, 82(4), 1076-80 * Abstract *	3,4	
A	CHEMICAL ABSTRACTS, vol. 106, 1987, page 160, abstract no. 114522j, Columbus, Ohio, US; B. SPRINGER et al.: "The shrunken gene on chromosome 9 of Zea mays L is expressed in various plant tissues and encodes an anaerobic protein", & MGG, MOL. GEN. GENET. 1986, 205(3), 461-8 * Abstract *	1	
D,A	PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE USA, vol. 82, no. 17, September 1985, pages 5824-5828, Washington, US; M. FROMM et al.: "Expression of genes transferred into monocot and dicot plant cells by electroporation" * Whole document *	30,31	
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (Int. Cl. 4)
Place of search THE HAGUE		Date of completion of the search 20-04-1990	Examiner MADDOX A.D.
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		I : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons * : member of the same patent family, corresponding document	



DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. 4)
O,A	PLANT BIOLOGY, vol. 3, PLANT TISSUE AND CELL CULTURE, With INTERNATIONAL CONGRESS, St. Paul, Minnesota, US, 3rd-8th August 1986, pages 303-316, Alan R. Liss, Inc.; H. LÖRZ et al.: "Gene transfer in cereals" * Page 307, last paragraph; page 308, table 2 * -----	1,31,2	
			TECHNICAL FIELDS SEARCHED (Int. Cl.4)
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 20-04-1990	Examiner MADDOX A.D.
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons * : member of the same patent family, corresponding document			